

# AVIATION AND AERONAUTICAL ENGINEERING



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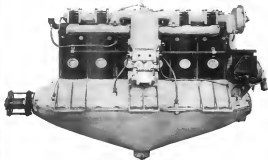
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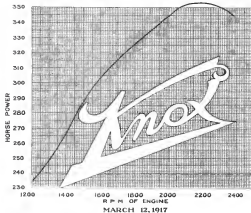
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MAY 1, 1917

## AVIATION AND AERONAUTICAL ENGINEERING

VOL. II, NO. 7

Member of the Associated Business Papers

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# AVIATION AND AERONAUTICAL ENGINEERING

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No. 7

**T**HE time has arrived when attention regarding the development of aviation in the United States will have to be directed in guarded terms. It is generally recognized that the planes of the Signal Corps for the coming year have already been given out, but the knowledge that these planes are well under way will also give forces regarding that branch of the service and will inspire increased confidence in those on whom the responsibility for this work devolves.

For Airs, aviation appropriations amounting to \$5,000,000 have been asked for—a sum so large that a year ago it would have been considered impossible to secure. But the examples, as well as the motives of France and England are now directly available, and as no doubts that they are receiving careful consideration by both the Army and the Navy.

Six million dollars are wanted for personnel. This amount will probably be enough to take care of all the plans who can be trained with the machines which will be available.

Aviation is rapidly being recognized as the most important branch of military service. It is the one duty in which individual initiative is almost sure to be still possible. When a military aviation is won in a manner the most of the losses the ground is because an individual effort is nearly as much as possible in military service. When a man is in a position to be a soldier, he is not only to attack from his machine and airman, but he is also to make it necessary to instantly change all his plans. This is the only way in which, as well as the fact that aviation is looked upon as an American service, and in strengthening thousands of young men to the service. Fortunately, with the limited equipment of airplanes comparatively few of these potential volunteers can hope to be trained in the near future.

Ten million dollars are wanted for the purchase of land and equipment for Airs, aviation. Last year appropriations made no provision for the improvement of present aviation sites, and as a result the Army is now training on leased land on which such the last ground and equipment is not so much. Investigation is being made in connection with the one problem has brought out the fact that its solution will be difficult and expensive. Such a further consideration of physical conditions are required that the needs of suitable locations are very much limited.

The remaining \$45,000,000 will be needed for the equipment of airplanes, squadrons and for training machines. In a situation like the present one, especially in view of the fact that the aviation service has been ignored so long by the Government, no time should be

lost in making these funds available. And when they are available the work of building up the aeronautical industry must begin in earnest.

### Curtiss Wright Rejoins the Commercial Field

The return of Curtiss Wright to the commercial field of aeronautics will be noted with pleasure and satisfaction by all who believe that his contribution to the progress of the world did not stop with the model B.

With countries who are recognized in the engineering world as men of foresight and as practical manufacturers the new work to be undertaken under Mr. Wright's direction will be watched with the greatest interest by all concerned with aeronautics.

### Speeding Up Production

The question of speeding up production is the most important problem at this time. The Government is in urgent need of the machines that are already on order so that it can train aviators; it is anxious to place further contracts with manufacturers who can give satisfactory guarantees that they are in position to receive orders for prompt delivery of airplanes, dirigibles, and balloons, so that training can be given to the many more men than the comparatively few machines now delivered or ordered can permit.

It is to the advantage of all manufacturers of aircraft, as well as of aeronautical accessories, to so arrange their facilities as to be in position to assist the Government in every possible manner. While these manufacturers have been working with whole-hearted interest and energy in building up the new industry, any special efforts which they, with their constantly widening experience, may now be able to put forth cannot help but receive recognition by the War and Navy Departments. Such efforts will further serve as the best assurance of receiving a share of the larger orders that are sure to be placed in the near future.

Plans of such scope are being offered for the closest cooperation between Federal, State and local governments and the various shipbuilders, and aircraft manufacturers, and this cooperation is taking the form of loans and other indirect financial assistance.

There is certainly an great need for the Government to speed this broad emergency policy to include airplane manufacturers, if those of the smaller companies who have demonstrated that they can produce efficient airplanes are to assist in securing the necessary production required for the training of aviators. It would be a wise step, in view of the emergency conditions.





The most straightforward way of finding out what tendency to the right bank the machine is under steady landing conditions, is to cut off trail and elevator and use a tail fin, and then find the angle of incidence, 37½ deg, will satisfy conditions.

The drag on the model at this angle is 0.113 lb, and the lift 0.099 lb at 30 m.p.h. The two equations are very nearly satisfied. Thus referring to full size conditions:

$$113 \text{ lb} \times 30 \text{ deg.} = 14,955 \text{ (0.099 lb) } \times 0.1225 = 0.113 \text{ lb}$$

$$\frac{0.113 \times 30}{30} = \frac{P^2}{30} \text{ and } P^2 = 14,955 \times 0.122 \text{ mph}$$

$$(12) \text{ } P = \cos 30 \text{ deg.} = 0.866 \text{ (0.099 lb) } \times 3000 \text{ which}$$

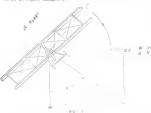
$$\frac{0.099 \times 3000}{0.866} = 0.14959 \times \text{Lift} = 0.0412 \text{ lb}$$

the difference of 19 lb is the lift being required.

If, at this point, the pilot throws the elevator hard up, it will increase the angle of attack rapidly, and move the path more and more to the horizontal. The equation with which it was set out at the first stage in the form which he was bringing to bear on the elevator, and is essential to the motion of the machine, and the damping against angular rotation. There is reason to believe that during this process he loses very little speed. The equation of motion during this process are not very complicated and cannot be solved directly. But if we assume that for a machine of this type, the pilot can change his angle of incidence to act, 5 deg, without losing speed, the lift on the model at this speed being 1.083, the lift on the machine becomes:

$$\frac{1.083}{30} \times 30 \times 0.122 = 14.400 \text{ lb}$$

or a load of 14.4 lbs (less the weight of the machine). It is commonly accepted that the actual load is not quite so great, being between 5 and 6. The pilot could not sustain such a machine with moderately strong controls, and weights distributed far from the center of gravity giving a large moment of inertia. But with a light machine, with weights close to the center of gravity, and a powerful elevator, a reckless aviator would be lightly disgraced.



It should be pointed out that the uncertainty as to the exact motion of a machine goes through on banking out, makes the question of the angles of incidence at which loads on front and rear spars should be distributed and compared a very complicated one. The lateral L-R Army specifications call for a wing diagram of 35 deg, which shows the greatest load on the front spar. If it is quite possible, a machine banking out after a steep dive does not reach such a high angle of incidence, but arrives at some intermediate angle such as the 5 deg mentioned above, then it would be better to draw a wing diagram of this angle of incidence, with a more equal distribution between the two spars.

(13) Landing in Heavy Breeze

The landing on a steep bank is dependent on the speed, nature of bank, and angle of bank.

In the sketch, Fig. 2, the machine is moving out of the plane

of the paper and turning in an angle of bank  $\theta$ . The lift force acting is the vertical plane of the machine as the lift, the weight and the damping force, which may be assumed as acting at the center of gravity of the machine. If we take along the line of these three forces, we have as equivalent of equilibrium:

$$L \sin \theta = W, \quad L \cos \theta = W + D$$

where  $L$  is speed in feet per second, and  $W$  is weight in lbs. From these equations, one can find the lift, that in a steep bank where  $\sin \theta$  is small the lift on the vertical plane is insufficient, and that before banking a pilot must increase his power and speed, otherwise his machine may drop on the bank.

The load on the machine in banking will increase with the centrifugal force to be overcome in addition to the weight, and, therefore, greater when the velocity has increased and the acceleration is normal flight and when the radius of turn is very small.

For the Clark model previously considered, we will assume that the machine has attained a speed of 120 m.p.h. or 176 ft. per second, after a dive and that the pilot goes into a steep turn at 400 feet radius.

$$\text{From the equations of equilibrium we have}$$

$$\frac{W}{L} = \frac{P^2}{L^2} = \frac{1}{\sin^2 \theta} = \frac{26,000}{122^2} = 1.7$$

$$\sin \theta = \frac{W}{L} = \frac{1}{1.7} = \frac{1}{1.7} = 0.588$$

$$\theta = 36 \text{ deg and } L = 2384 \text{ which is certainly a fairly steep angle of bank. Thus } L \cos \theta, L \sin \theta, L = 2384$$

If it is possible to consider a case where the velocity would be still greater than the 120 m.p.h. per hour, and the radius still smaller in which case the banking might still be better. It does not seem probable, however, that the worst possible landing on a bank would exceed 2 or 3 ft.

The angle of incidence on a bank rotates in space from the point of a center of pressure and distribution of pressure between the two spars. Considering the Clark model at the previous paragraph,  $L = 1040$  and  $L = 2300$  ft. = 1100 =  $K_1 \times 354 \times 1249$

$$\text{then which } K_1 = \frac{1040}{354 \times 1249} = 0.000215$$

and the angle of incidence is not much above 4 deg, but for the Clark machine on such a bank.

(14) Landing in Landing

In landing under such conditions it is suggested in the following diagram and after a dive. The probable maximum landing is indicated by the 4.

(15) Steep Dive to Landing

Another thing of rather interest is in the nature of spins made on a machine, where the pilot tends to maintain the same speed but at a different angle of incidence, or the same incidence for a different speed.

The machine, then, essentially:

- (a) a head-on gust
- (b) a following gust
- (c) an updraft
- (d) a down-draft

limited to a sufficiently sudden gust, there is no possible limit to the stresses which may come on a machine in such cases, and a human pilot could not survive for a while for a while in such a case. It is necessary to investigate, for such a while, the gravity, as we may say, in order to make sure that the machine is not too small, and we will not get into it.

(16) Steep Dive to Landing

Imagine the Clark machine is to be moving at 60 m.p.h. at an angle of incidence 4 deg, against a head-on wind of 30 m.p.h. so that its absolute velocity relative to the earth is 30 m.p.h. If the head-on wind now increases to 30 m.p.h. so that its absolute velocity relative to the earth will still remain at 30 m.p.h. but at a speed of two. During this period, the velocity to the air will increase to 60 m.p.h. per hour, with the angle of incidence unchanged. The lift on the machine will, therefore, be momentarily increased to the ratio of

$$\frac{60^2}{30^2} = 4$$

There will be an increase in speed and an increased load on the machine = 2 times.

(17) Following Gust

If the machine were traveling in a following wind, which



equally diminished, a similar action would occur, since the ratio of the lift to the air will be the same.

If, on the other hand, in the case considered above the head-on gust suddenly diminished to 16 m.p.h. on the machine (which is about 1/3 of the original speed), the lift would be decreased to 40 m.p.h. per hour and the lift would be diminished to the ratio of  $\frac{16^2}{60^2} = 0.06$  and the lift

on the wings would, in the case, be actually less than in normal flight, so that the machine would drop.

It is clear that from the above that the gust effects are most important, then, the speed of the machine is lost.

(18) Updrafts and Downdrafts

When going into normal or under, one can see easily from Fig. 4, the effect of an updraft in increasing the load. The up draft both increases the velocity of the machine and the angle of incidence, with a corresponding increase in lift, except at very high angles where a severe effect is possible. For a down-draft the contrary would hold true.

As a normal flying machine, the effect of a gust should never increase the load to more than two or three times the weight of the machine.



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(32) Updrafts and Downdrafts

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### Dynson Wright Aeroplane Co. Organized

Announcement is made of the formation of the Dynson Wright Aeroplane Co., with \$500,000 capital and the Wright Plant Co., with a capital of \$100,000, both with offices at Dayton, Ohio.

The directors are: Dynson Wright, Edward A. Dwyer, president of the Dynson Wright Aeroplane Co.; Charles F. Burtis, Harry H. Feltus and Harry F. Sawyer of the latter named being president.

The aeroplane company will manufacture airplanes and the latter company will manufacture an aviation school, which is expected to work in cooperation with the United States Army, in conducting military aviation.

The school will be situated under the direct supervision of Mr. Wright, with Edward A. Dwyer as chief instructor. The formal opening will take place between May 20th and June 1st.

Mechanics are already under contract and are being employed with Hallam students. It is expected that the first of the new machines will take the air within two weeks.

### New Naval Aviation School

Lieut. Robert H. Hanson, 2d lieutenant of the navy, commanding officer of the Massachusetts 1st squadron in Public Harbor, has requested that notice be given that the Naval aviation school at Annapolis, which was authorized to open on June 1 will now open on May 15 next after.

This change in the opening date for classes at the new aviation school is possible because of the improved plans to promote the growth and in the work on the navy's air.

Because of this improvement of the opening date it is possible to train new recruits of men that had been recruited and therefore the training at Naval Aviation requests that all new recruits to apply for admission to these classes appear personally at the house of the new recruit at the Navy House, a trip of it to recruit and should be obtained.

On July 1st, the Naval aviation classes application must be between 15 and 24 years of age and have a college education or in a college course or in a high school course (uninterrupted) and must be of good physical health, and must be of legal age and bearing.



MAJOR E. M. H. HAYS, U.S. ARMY, FORMERLY MAJOR, 1ST FIELD ARTILLERY, BOSTON, MASS.

### Map. Hays, Goes to Fort Omaha

Major E. M. Hays, who recently was at the head of the Military Academy, has been assigned to Fort Omaha, Nebraska, as chief of the 1st Field Artillery, and will proceed to Fort Omaha in June.

Colorado Students Form U.S. Club, founded and ready for training and of a number of officers, New York City, have created a division, organized by the National Aeronautics Club, Colorado, and it is the first of its kind in the United States. The club has been given the use of a machine in training in Denver, Colorado, and it is the first of its kind in the United States. The club has been given the use of a machine in training in Denver, Colorado, and it is the first of its kind in the United States.

### First Naval District Station

A naval station station, - stationing, has been opened at Washington, D.C., in the naval district. The station is the first of its kind in the United States. The station is the first of its kind in the United States.

### Rockhampton Bushing Factory

The Rockhampton Bushing Corp. of New York has been the construction of a factory on the shore of the Erie River, New York. The factory is the first of its kind in the United States.

### Army School in Chicago

The War Department has recently completed arrangements for the opening of a military school for officers at the field of the Illinois Army Park at Rockhampton, Illinois.

The site was selected by the War Department and the school is the first of its kind in the United States.

The school is the first of its kind in the United States. The school is the first of its kind in the United States.

### St. Louis Wants Army School

Legislators are being created for a campaign in support of the St. Louis Army School. The school is the first of its kind in the United States.

The school is the first of its kind in the United States. The school is the first of its kind in the United States.

### George Engine Construction

In the construction of the 100 H.P. engine, George Engine Co. has been the first of its kind in the United States. The engine is the first of its kind in the United States.

### New Curtiss School at Buffalo

The new Curtiss school at the Curtiss Co. in Lake Erie is expected to open in the fall. The school is the first of its kind in the United States.

## CURTISS AEROPLANE & MOTOR CORPORATION

MADE BY THE CURTISS ENGINE CO. OF ILL.

CURTISS "V" ENGINE

140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000

1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

CONSUMPTION PER HOUR

## Curtiss

THE Motor shown above is a Curtiss V-engine, 4 stroke cycle, rated at 200 H.P. at 1000 R.P.M.

Weight with propeller 140-150 pounds.

Full information and literature disseminated gladly furnished on request.

## CURTISS AEROPLANE & MOTOR CORPORATION

BUFFALO, N. Y.





THOMAS NAVY HYDROAIRPLANE, TYPE SH-4

This machine has been designed particularly for training purposes, for either land or water use. Good inherent stability is secured by careful balance and moderate dihedral wing setting. Control surfaces are of generous dimensions to insure ease of handling under all conditions.

Speed ranges 40 to 65 M. P. H. with 100 H. P. motor

Contractors to U. S. Army and Navy

**THOMAS-MORSE AIRCRAFT CORPORATION**  
SUCCESSORS TO THOMAS MORSE AIRCRAFT CO., INC. ITHACA, N. Y.



BURGESS PRIMARY TRAINING TRACTOR, TYPE B P

This machine was designed by W. Sterling Burgess at the request of the United States Army for a primary training tractor having a practical side by side seating arrangement with duplicate controls.

This has been accomplished without sacrificing in the least the efficiency or appearance of the machine.

It fills the urgent need found at present in the aviation schools—giving great range of control and allowing the instructor to be at side of the pupil during flight, thereby facilitating instruction.

This has been proven very satisfactorily in experimental flights as well as in the official tests through which this machine passed with great success.

**THE BURGESS COMPANY, Marblehead, Mass.**  
MANUFACTURERS OF THE BURGESS TRAINER AND BURGESS BATTLEPLANES  
SOLE LICENSEES FOR THE UNITED STATES



**Sturtevant**

Speed Range with two persons and four hours fuel \*38-75 M. P. H.  
Powered with Sturtevant 8 cyl. 140 H. P. Aluminum Motor

Unusual Load-carrying and Safety Reserve

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**The Flint Aircraft Co., Inc.**

**Airplanes of Military Types**

**Flint, Michigan**

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PARED TO FUR-  
NISH THE VERY  
HIGHEST GRADE

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Weights and Colors

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ANT  
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Scaplanes  
Flying Boats

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In actual service have substantiated every claim made for them and more.

Their wonderful strength and resiliency are best evidenced by their ability to absorb shock and prevent rebound in landing and getting away.

Orders and inquiries from America and foreign countries are conclusive proof that Ackerman wheels are meeting with favor from manufacturers and pilots.

ACKERMAN WHEELS are built in different sizes  
to carry any load from 200 pounds and up

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mailed upon request

THE ACKERMAN WHEEL CO.  
BOWENFISHER BUILDING, CLEVELAND, O.



Wittemann-Lewis Model 2-C, 90 h. p.

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## ELJ-5

Officers of the Heavier-than-air Services of the United States and their Allies are invited to inspect the

**Janney Aircraft Company's**

**New Model  
Training Tractor  
Biplane ELJ-5**

With Hall-Scott A-5 Six Cylinder Engine

*Detailed Descriptions  
upon request*

**JANNEY AIRCRAFT CO.**  
WINDSOR, MICH.

## C. A. Herrmann

DESIGN AND CONSTRUCTION

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Bath, N. Y.

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The excelsior without an equal. They are superior to any propeller produced. They are used exclusively by all the leading airlines. Long blades and proven design. 200 GRADES. THE BEST AT THE SAME PRICE FOR ALL. BODILESS PRIDE.

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ST. LOUIS, MO.

## AIRPLANE CRANKSHAFTS

With a Perfect Record

**WYMAN-GORDON COMPANY**

WORCESTER, MASS., U. S. A.

ESTABLISHED 1899



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The COURSE IN AERODYNAMICS AND AEROPLANE DESIGN, by the Instructors in Aeronautics in the Massachusetts Institute of Technology.

SPECIAL TECHNICAL ARTICLES written by the leaders in the Profession on Every Phase of AERONAUTICAL PROGRESS.

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The Doings of the AERO CLUBS and all the FEDERAL and STATE MILITARY and NAVAL NEWS.

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## A POPULAR PRICE LAND OR WATER PLANE

**TWO  
PLACE  
LAND  
MODEL  
\$3,000**



**TWO  
PLACE  
WATER  
MODEL  
\$3,100**

**KYLE SMITH AIRCRAFT CO.**

**WHEELING, W. VA.**



Can be applied to 4, 6, 8, and 12 Cylinder Engines

## The "Christensen Self-Starter" for Aviation Motors

WEIGHS ONLY 40 LBS. COMPLETE

Uses Gasoline and Air, Furnishing the Compression Stroke of the Motor Without Turning It

Starts Big Motors With Greatest Ease. Cold Weather Does Not Affect Its Efficiency.

Standard Equipment on "Thomas" Motors. Used by U. S. Army and Navy

WRITE FOR CATALOG OF ALL MODELS

**THE CHRISTENSEN ENGINEERING CO., Milwaukee, Wis.**





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Every stage is carefully tested by chemists and inspectors long experienced in such work. This is part of our service, due to the value of our superior quality.

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Du Pont Dope is the product of chemical specialists on cellulose solutions who have been in close touch with the development and requirements of the airplane industry since its inception in this country.

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All our products are rigidly inspected and meet all Government requirements.

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## The Buck Automatic Aerial Torpedo

AFTER a series of tests in Colorado, the Buck Aircraft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 30 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance. The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedoes can be fired at any range and at any degree of the compass. The launching of the torpedo is without shock, and consequently the most diversely explosive materials can be carried.

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